MODEL PAX2A – 1/8 DIN ANALOG PANEL METER

**DESCRIPTION**

The PAX2A Analog Panel Meter offers many features and performance capabilities to suit a wide range of industrial applications. The PAX2A has a universal input to handle various input signals including DC Voltage/Current, Process, Resistance and Temperature. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs. The PAX2A employs a dual line, tri color display with a large 0.71", tri color 6 digit top display line and a 0.35", 9 digit green bottom display line.

The meters provide a MAX and MIN reading memory with programmable capture time. The capture time is used to prevent detection of false max or min readings which may occur during start-up or unusual process events.

The signal totalizer (integrator) can be used to compute a time-input product. This can be used to provide a readout of totalized flow or calculate service intervals of motors, pumps, etc. The meters have up to four setpoint outputs, implemented on plug-in option cards. The plug-in cards provide dual FORM-C relays (5A), quad FORM-A (3A), or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

Communication and bus capabilities are also available as option cards. These include RS232, RS485, DeviceNet, and Profibus-DP. The PAX2A can be programmed to utilize ModBus protocol. With ModBus, the user has access to most configuration parameters. Readout values and setpoint alarm values can be controlled through the bus. Additionally, the meters have a feature that allows a remote computer to directly control the outputs of the meter.

The PAX2A includes a built-in USB programming port that makes it possible to configure the meter using a Windows® based program, without any additional communication option cards. The configuration data can be saved to a file for later recall.

A linear DC output signal is available as an optional plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max or min readings. Once the meters have been initially configured, the parameter list may be locked out from further modification in its entirety or partially locked allowing the setpoint values to remain accessible.

The meters have been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing of noise effects and CE requirements, the meter provides a tough yet reliable application solution.

**SAFETY SUMMARY**

All safety related regulations, local codes and instructions that appear in this literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the unit.
ORDERING INFORMATION

Meter Part Numbers

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAX2A</td>
<td>Universal DC Analog Input Panel Meter</td>
<td>PAX2A000</td>
</tr>
</tbody>
</table>

Option Card and Accessories Part Numbers

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Plug-In Cards</td>
<td>PAXCDS</td>
<td>Dual Setpoint Relay Output Card</td>
<td>PAXCDS10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Relay Output Card</td>
<td>PAXCDS20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Sinking Open Collector Output Card</td>
<td>PAXCDS30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Sourcing Open Collector Output Card</td>
<td>PAXCDS40</td>
</tr>
<tr>
<td>PAXCDC</td>
<td></td>
<td>RS485 Serial Communications Card with Terminal Block</td>
<td>PAXCDC10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS485 Serial Communications Card with Dual RJ11 Connector</td>
<td>PAXCDC1C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS232 Serial Communications Card with Terminal Block</td>
<td>PAXCDC20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS232 Serial Communications Card with 9 Pin D Connector</td>
<td>PAXCDC2C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DeviceNet Communications Card</td>
<td>PAXCDC30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proflbus-DP Communications Card</td>
<td>PAXCDC50</td>
</tr>
<tr>
<td>PAXCDL</td>
<td></td>
<td>Analog Output Card</td>
<td>PAXCDL10</td>
</tr>
<tr>
<td>Accessories</td>
<td>SFCRD2</td>
<td>Crimson PC Configuration Software for Windows 98, ME, 2000 and XP</td>
<td>SFCRD200</td>
</tr>
</tbody>
</table>

Notes:

1. For Modbus communications use RS485 Communications Output Card and configure communication (T9E) parameter for Modbus.
2. Crimson software is available for free download from http://www.redlion.net/
GENERAL METER SPECIFICATIONS

1. DISPLAY: Positive image LCD
   Top Line - 6 digit, 0.71" (18 mm), with tri-color backlight (red, green or orange), display range: -999999 to 9999999;
   Bottom Line - 9 digit, 0.35" (8.9 mm), with green backlight, display range: -199,999,999 to 999,999,999

2. POWER:
   AC Power: 50 to 250 VAC, 50/60 Hz, 14 VA
   DC Power: 21.6 to 250 VDC, 8 W
   Isolation: 2300 Vrms for 1 min. to all inputs and outputs.

3. ANNUNCIATORS: Backlight color: Red
   - setpoint alarm 1
   - setpoint alarm 2
   - setpoint alarm 3
   - setpoint alarm 4
   Line 1 Units Label – programmable 3 digit units annunciator with tri-color backlight (red, green or orange)

4. KEYPAD: 2 programmable function keys, 4 keys total

5. A/D CONVERTER: 24 bit resolution

6. UPDATE RATES:
   A/D conversion rate: programmable 5 to 160 readings/sec.
   Step response:
<table>
<thead>
<tr>
<th>Input Rate</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>40</th>
<th>80</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Time*</td>
<td>600</td>
<td>400</td>
<td>200</td>
<td>100</td>
<td>50</td>
<td>30</td>
</tr>
</tbody>
</table>

* - msec. max. to within 99% of final readout value (digital filter disabled)

7. DISPLAY MESSAGES:
   "- . . . . ." - Appears when display values exceed - display range.
   ". . . . ." - Appears when display values exceed + display range.
   "OPEN" - Appears when open sensor is detected.
   "Short" - Appears when shorted sensor is detected. (RTD only)
   "ULUL" - Appears when measurement exceeds - signal range.

8. INPUT CAPABILITIES:

   Current Input:
<table>
<thead>
<tr>
<th>INPUT</th>
<th>ACCURACY (18 to 28°C)</th>
<th>ACCURACY (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONT. OVERLOAD</th>
<th>* RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 250 μA DC</td>
<td>0.03% of rdg + μA</td>
<td>0.12% of rdg + μA</td>
<td>1.11 KΩ</td>
<td>mA</td>
<td>10mA</td>
</tr>
<tr>
<td>± 2.5 mA DC</td>
<td>0.03% of rdg + μA</td>
<td>0.12% of rdg + μA</td>
<td>111 Ω</td>
<td>mA</td>
<td>0.1μA</td>
</tr>
<tr>
<td>± 25 mA DC</td>
<td>0.03% of rdg + μA</td>
<td>0.12% of rdg + μA</td>
<td>11.1 Ω</td>
<td>mA</td>
<td>1μA</td>
</tr>
<tr>
<td>± 250 mA DC</td>
<td>0.05% of rdg + μA</td>
<td>0.12% of rdg + μA</td>
<td>1.1 Ω</td>
<td>mA</td>
<td>10μA</td>
</tr>
<tr>
<td>± 2 ADC</td>
<td>0.5% of rdg + mA</td>
<td>0.7% of rdg + mA</td>
<td>0.1 Ω</td>
<td>mA</td>
<td>0.1mA</td>
</tr>
</tbody>
</table>

* Higher resolution can be achieved via input scaling.

Voltage Input:

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY (18 to 28°C)</th>
<th>ACCURACY (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONT. OVERLOAD</th>
<th>* RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 250 mVDC</td>
<td>0.03% of rdg + μV</td>
<td>0.12% of rdg + μV</td>
<td>451 KΩ</td>
<td>V</td>
<td>10μV</td>
</tr>
<tr>
<td>± 2.0 VDC</td>
<td>0.03% of rdg + μV</td>
<td>0.12% of rdg + μV</td>
<td>451 KΩ</td>
<td>V</td>
<td>0.1mV</td>
</tr>
<tr>
<td>± 10 VDC</td>
<td>0.03% of rdg + μV</td>
<td>0.12% of rdg + μV</td>
<td>451 KΩ</td>
<td>V</td>
<td>1mV</td>
</tr>
<tr>
<td>± 25 VDC</td>
<td>0.03% of rdg + μV</td>
<td>0.12% of rdg + μV</td>
<td>451 KΩ</td>
<td>V</td>
<td>1mV</td>
</tr>
<tr>
<td>± 100 VDC</td>
<td>0.3% of rdg + mV</td>
<td>1.2% of rdg + mV</td>
<td>451 KΩ</td>
<td>V</td>
<td>10mV</td>
</tr>
<tr>
<td>± 200 VDC</td>
<td>0.3% of rdg + mV</td>
<td>1.2% of rdg + mV</td>
<td>451 KΩ</td>
<td>V</td>
<td>10mV</td>
</tr>
</tbody>
</table>

* Higher resolution can be achieved via input scaling.

9. EXCITATION POWER: Jumper selectable
   Transmitter Power: +18 VDC @ 50 mA
   Reference Voltage: +2 VDC, +/- 2%
   Compliance: 1KΩ load max (2 mA max)
   Temperature Coefficient: 40 ppm/°C max.
   Reference Current: 1.05 mADC, +/- 2%
   Compliance: 10 KΩ load max.
   Temperature Coefficient: 40 ppm/°C max.

10. USER INPUTS: Two programmable user inputs
   Max. Continuous Input: 20 VDC
   Isolation To Sensor Input Common: Not isolated.
   Response Time: 12 msec. max.

THERMOCOUPLE INPUTS:

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>RANGE</th>
<th>ACCURACY* (18 to 28 °C)</th>
<th>ACCURACY* (0 to 50 °C)</th>
<th>STANDARD</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>-200 to 400°C</td>
<td>1.2°C</td>
<td>2.1°C</td>
<td>ITS-90 (+) blue</td>
<td>(-) red</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>**</td>
<td>**</td>
<td>(+) white</td>
<td>(-) blue</td>
</tr>
<tr>
<td>E</td>
<td>-200 to 871°C</td>
<td>1.0°C</td>
<td>2.4°C</td>
<td>ITS-90 (+) purple</td>
<td>(+) brown</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>**</td>
<td>**</td>
<td>(+) yellow</td>
<td>(-) blue</td>
</tr>
<tr>
<td>J</td>
<td>-200 to 760°C</td>
<td>1.1°C</td>
<td>2.3°C</td>
<td>ITS-90 (+) white</td>
<td>(-) red</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>**</td>
<td>**</td>
<td>(+) yellow</td>
<td>(-) blue</td>
</tr>
<tr>
<td>K</td>
<td>-200 to 1372°C</td>
<td>1.3°C</td>
<td>3.4°C</td>
<td>ITS-90 (+) yellow</td>
<td>(-) red</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>**</td>
<td>**</td>
<td>(+) brown</td>
<td>(-) blue</td>
</tr>
<tr>
<td>R</td>
<td>-50 to 1768°C</td>
<td>1.9°C</td>
<td>4.0°C</td>
<td>ITS-90 no standard</td>
<td>(+) white</td>
</tr>
<tr>
<td>S</td>
<td>-50 to 1768°C</td>
<td>1.9°C</td>
<td>4.0°C</td>
<td>ITS-90 no standard</td>
<td>(+) white</td>
</tr>
<tr>
<td>B</td>
<td>100 to 300°C</td>
<td>3.9°C</td>
<td>4.4°C</td>
<td>ITS-90 no standard</td>
<td>no standard</td>
</tr>
<tr>
<td></td>
<td>300 to 1820°C</td>
<td>3.9°C</td>
<td>4.4°C</td>
<td>ITS-90 no standard</td>
<td>no standard</td>
</tr>
<tr>
<td>N</td>
<td>-200 to 1300°C</td>
<td>1.3°C</td>
<td>3.1°C</td>
<td>ITS-90 (+) orange</td>
<td>(-) red</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>**</td>
<td>**</td>
<td>(+) orange</td>
<td>(-) blue</td>
</tr>
<tr>
<td>C</td>
<td>(W5/W26)</td>
<td>0 to 2315°C</td>
<td>1.9°C</td>
<td>6.1°C</td>
<td>ASTM E988-90**</td>
</tr>
</tbody>
</table>

* After 20 min. warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 15 to 75% RH environment; and Accuracy over a 0 to 50°C and 0 to 85% RH (non condensing) environment. Accuracy specified over the 0 to 50°C operating range includes meter tempco and ice point tracking effects. The specification includes the A/D conversion errors, linearization conformity, and thermocouple ice point compensation. Total system accuracy is the sum of meter and probe errors. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

** The accuracy over the interval -270 to -200°C is a function of temperature, ranging from 1°C at -200°C and degrading to 7°C at -270°C. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

*** These curves have been corrected to ITS-90.

RTD Inputs:

Type: 3 or 4 wire, 2 wire can be compensated for lead wire resistance
Excitation current: 100 ohm range: 165 μA
10 ohm range: 2.6 mA
Lead resistance: 100 ohm range: 10 ohm/lead max.
10 ohm range: 3 ohms/lead max.
Max. continuous overload: 30 V

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>RANGE</th>
<th>ACCURACY* (18 to 28 °C)</th>
<th>ACCURACY* (0 to 50 °C)</th>
<th>STANDARD ***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-200 to 850°C</td>
<td>0.4°C</td>
<td>1.6°C</td>
<td>IEC 751</td>
</tr>
<tr>
<td>100 ohm Pt alpha = .000385</td>
<td>-200 to 850°C</td>
<td>0.4°C</td>
<td>1.6°C</td>
<td>no official standard</td>
</tr>
<tr>
<td>100 ohm Pt alpha = .000392</td>
<td>-200 to 850°C</td>
<td>0.4°C</td>
<td>1.6°C</td>
<td>no official standard</td>
</tr>
<tr>
<td>120 ohm Nickel alpha = .00672</td>
<td>-80 to 260°C</td>
<td>0.2°C</td>
<td>0.5°C</td>
<td>no official standard</td>
</tr>
<tr>
<td>10 ohm Copper alpha = .00427</td>
<td>-100 to 260°C</td>
<td>0.4°C</td>
<td>0.9°C</td>
<td>no official standard</td>
</tr>
</tbody>
</table>

1. THERMOCOUPLE INPUTS: Input Impedance: 20ΜΩ
2. Lead Resistance Effect: 0.03 %V/Ω
3. Max Continuous Overvoltage: 30 V

4. SCALE: F or C
5. Bottom Range: -199,999 to 999,999
Logic State: User programmable (USrAct) for sink/source (LO/HI) logic

<table>
<thead>
<tr>
<th>INPUT STATE</th>
<th>SINKING INPUTS</th>
<th>SOURCING INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>$V_{IN} &lt; 1.1 \text{ VDC}$</td>
<td>$V_{IN} &gt; 2.3 \text{ VDC}$</td>
</tr>
<tr>
<td>Inactive</td>
<td>$V_{IN} &gt; 2.3 \text{ VDC}$</td>
<td>$V_{IN} &lt; 1.1 \text{ VDC}$</td>
</tr>
</tbody>
</table>

11. **TOTALIZER:**
   - Time Base: second, minute, hour, or day
   - Batch: Can accumulate (gate) input display from a user input
   - Time Accuracy: 0.01% typical
   - Decimal Point: 0 to 0.0000
   - Scale Factor: 0.001 to 65.000
   - Low Signal Cut-out: -19,999 to 99,999
   - Total: 9 digits, display alternates between high order and low order readouts

12. **CUSTOM LINEARIZATION:**
   - Data Point Pairs: Selectable from 2 to 16
   - Display Range: -19,999 to 99,999
   - Decimal Point: 0 to 0.0000
   - Ice Point Compensation: user value (0.00 to 650.00 μV/C)

13. **MEMORY:** Nonvolatile E²PROM memory retains all programmable parameters and display values.

14. **ENVIRONMENTAL CONDITIONS:**
   - Operating Temperature Range: 0 to 50 °C (0 to 45 °C with all three plug-in cards installed)
   - Storage Temperature Range: -40 to 60 °C
   - Operating and Storage Humidity: 0 to 85% max. RH non-condensing
   - Altitude: Up to 2000 meters

15. **CERTIFICATIONS AND COMPLIANCES:**
   - Consult factory for details.
   - Refer to EMC Installation Guidelines section of the bulletin for additional information.

16. **CONNECTIONS:**
   - High compression cage-clamp terminal block
   - Wire Strip Length: 0.3" (7.5 mm)
   - Wire Gauge Capacity: One 14 AWG (2.55 mm) solid, two 18 AWG (1.02 mm) or four 20 AWG (0.61 mm)

17. **CONSTRUCTION:**
   - This unit is rated for NEMA 4X/IP65 indoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.

18. **WEIGHT:** 8 oz. (226.8 g)
**Optional Plug-in Output Cards**

**WARNING:** Disconnect all power to the unit before installing plug-in cards.

**Adding Option Cards**
The PAX2A meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The plug-in cards can be installed initially or at a later date.

**COMMUNICATION CARDS (PAXCDC)**
A variety of communication protocols are available for the PAX2A meter. Only one PAXCDC card can be installed at a time. Note: For Modbus communications use RS485 Communications Output Card and configure communication (t) parameter for Modbus.

- PAXCDC10 - RS485 Serial (Terminal)
- PAXCDC11 - RS485 Serial (Connector)
- PAXCDC20 - RS232 Serial (Terminal)
- PAXCDC21 - RS232 Serial (Connector)

**SERIAL COMMUNICATIONS CARD**
Type: RS485 or RS232  
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.  
Working Voltage: 50 V.  Not Isolated from all other commons.

- Data: 7/8 bits  
- Baud: 300 to 19,200  
- Parity: no, odd or even  
- Bus Address: Selectable 0 to 99, Max. 32 meters per line (RS485)  
- Transmit Delay: Selectable for 2 to 50 msec or 50 to 100 msec (RS485)

**DEVICENET™ CARD**
Compatibility: Group 2 Server Only, not UCMM capable  
Baud Rates: 125 Kbaud, 250 Kbaud, and 500 Kbaud  
Bus Interface: Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I Section 10.2.2.  
Node Isolation: Bus powered, isolated node  
Host Isolation: 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.

**PROFIBUS-DP CARD**
Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC  
Conformance: PNO Certified Profibus-DP Slave Device  
Baud Rate: Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud  
Station Address: 0 to 126, set by the master over the network. Address stored in non-volatile memory.  
Connection: 9-pin Female D-Sub connector  
Network Isolation: 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

**PROGRAMMING SOFTWARE**
The Crimson® software is a Windows® based program that allows configuration of the PAX® meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the meter. The meter’s program can then be saved in a PC file for future use. A PAX® serial plug-in card is required to program the meter using the software.

**PROGRAMMING SOFTWARE**

```
Adding Option Cards
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- PAXCDC10 - RS485 Serial (Terminal)
- PAXCDC30 - DeviceNet
- PAXCDC50 - Profibus-DP
- PAXCDC20 - RS232 Serial (Terminal)
- PAXCDC21 - RS232 Serial (Connector)

**SERIAL COMMUNICATIONS CARD**
Type: RS485 or RS232  
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.  
Working Voltage: 50 V.  Not Isolated from all other commons.

- Data: 7/8 bits  
- Baud: 300 to 19,200  
- Parity: no, odd or even  
- Bus Address: Selectable 0 to 99, Max. 32 meters per line (RS485)  
- Transmit Delay: Selectable for 2 to 50 msec or 50 to 100 msec (RS485)

**DEVICENET™ CARD**
Compatibility: Group 2 Server Only, not UCMM capable  
Baud Rates: 125 Kbaud, 250 Kbaud, and 500 Kbaud  
Bus Interface: Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I Section 10.2.2.  
Node Isolation: Bus powered, isolated node  
Host Isolation: 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.

**PROFIBUS-DP CARD**
Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC  
Conformance: PNO Certified Profibus-DP Slave Device  
Baud Rate: Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud  
Station Address: 0 to 126, set by the master over the network. Address stored in non-volatile memory.  
Connection: 9-pin Female D-Sub connector  
Network Isolation: 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

**PROGRAMMING SOFTWARE**
The Crimson® software is a Windows® based program that allows configuration of the PAX® meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the meter. The meter’s program can then be saved in a PC file for future use. A PAX® serial plug-in card is required to program the meter using the software.

**SETPOINT CARDS (PAXCDS)**
The PAX2A meter has 4 available setpoint alarm output plug-ins. Only one PAXCDS card can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

- PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
- PAXCDS20 - Quad Relay, FORM-A, Normally open only
- PAXCDS30 - Isolated quad sinking NPN open collector
- PAXCDS40 - Isolated quad sourcing PNP open collector

**DUAL RELAY CARD**
Type: Two FORM-C relays  
Isolation To Sensor & User Input Commons: 2000 Vrms for 1 min.  
Working Voltage: 240 Vrms

- Contact Rating: One Relay Energized: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 HP @120 VAC, inductive load  
  Total current with both relays energized not to exceed 5 amps

- Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

**QUAD RELAY CARD**
Type: Four FORM-A relays  
Isolation To Sensor & User Input Commons: 2300 Vrms for 1 min.  
Working Voltage: 250 Vrms

- Contact Rating: One Relay Energized: 3 amps @ 240 VAC or 30 VDC (resistive load), 1/10 HP @120 VAC, inductive load  
  Total current with all four relays energized not to exceed 4 amps

- Life Expectancy: 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

**QUAD SINKING OPEN COLLECTOR CARD**
Type: Four isolated sinking NPN transistors.  
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.  
Working Voltage: 50 V.  Not Isolated from all other commons.

- Rating: 100 mA max @ VSAT = 0.7 V max.  VMAX = 30 V

**QUAD SOURCING OPEN COLLECTOR CARD**
Type: Four isolated sourcing PNP transistors.  
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.  
Working Voltage: 50 V.  Not Isolated from all other commons.

- Rating: Internal supply: 18 VDC unregulated, 30 mA max. total  
  External supply: 30 VDC max., 100 mA max. each output

**ALL SETPOINT CARDS**
Response Time: 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)

- 700 msec. max. (digital filter disabled, internal zero correction enabled)

**LINEAR DC OUTPUT (PAXCDL)**
Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.

- PAXCDL10 - Retransmitted Analog Output Card

**ANALOG OUTPUT CARD**
Types: 0 to 20 mA, 4 to 20 mA or 0 to 10 VDC  
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.

- Working Voltage: 50 V.  Not Isolated from all other commons.
- Accuracy: 0.17% of FS (18 to 28 °C); 0.4% of FS (0 to 50 °C)
- Resolution: 1/3500
- Compliance: 10 VDC; 10 KΩ load min.,  20 mA: 500 Ω load max.
- Powered: Self-powered

- Update time: 200 msec. max. to within 99% of final output value (digital filter and internal zero correction disabled)

- 700 msec. max. (digital filter disabled, internal zero correction enabled)
1.0 Installing the Meter

Installation

The PAX2A meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.

While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

Installation Environment

The unit should be installed in a location that does not exceed the operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

2.0 Setting the Jumpers

The PAX2A meter has four jumpers that must be checked and/or changed prior to applying power. The following Jumper Selection Figures show an enlargement of the jumper area.

To access the jumpers, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

INPUT RANGE JUMPERS

Configuring Voltage/Ohms

Two jumpers are used in configuring the meter for voltage/ohms. The first jumper, V/T, must be in the V position. The second jumper is used to select the proper voltage input range. (This jumper is also used to select the current input range.) Select a range that is high enough to accommodate the maximum signal input to avoid overloads. For proper operation, the input range selected in programming must match the jumper setting.

Current Input

For current input, only one jumper must be configured to select the current range. This jumper is shared with the voltage input range. Select the jumper position that is high enough to accommodate the maximum signal input level to avoid overloads.

Note: The position of the V/T jumper does not matter when the meter is in the current input mode.

Temperature Input

For temperature measurement the V/T jumper must be in the T position. For RTD sensors the RTD jumper must also be set.

Excitation Output Jumper

This jumper is used to select the excitation range for the application. If excitation is not being used, it is not necessary to check or move this jumper.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.
3.0 Installing Plug-in Cards

The plug-in cards are separately purchased optional cards that perform specific functions. These cards plug into the main circuit board of the meter. The plug-in cards have many unique functions when used with the PAX2A. The literature that comes with these cards should be discarded, unless it specifically states in the plug-in card literature that the information applies to the PAX2A.

**CAUTION:** The plug-in card and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

To Install:
1. With the case open, locate the plug-in card connector for the card type to be installed. The types are keyed by position with different main circuit board connector locations. When installing the card, hold the meter by the rear terminals and not by the front display board.*
2. Install the plug-in card by aligning the card terminals with the slot bay in the rear cover. Be sure the connector is fully engaged and the tab on the plug-in card rests in the alignment slot on the display board.
3. Slide the meter base back into the case. Be sure the rear cover latches fully into the case.
4. Apply the plug-in card label to the bottom side of the meter in the designated area. Do Not Cover the vents on the top surface of the meter. The surface of the case must be clean for the label to adhere properly.

* Quad Sourcing Open Collector Output Card Supply Select

If installing the Quad sourcing Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before continuing.

4.0 Wiring the Meter

**Wiring Overview**

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter’s voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3” (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

**EMC Installation Guidelines**

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O noise, source or coupling method into the meter may be different for various

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables:
     - Fair-Rite # 0443167251 (RLC# FCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward # 28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/0 (RLC# LFCOR000)
     - Schaffner # FN670-1/8/07
     - Corcom # 1 VR3
   - Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubber: RLC# SNUB0000.
4.1 POWER WIRING

AC Power

DC Power

4.2 VOLTAGE/OHMS/CURRENT INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper and Excitation Jumper should be verified for proper position.

Voltage Signal (self powered)

Process/Current Signal (self powered)

Process/Current Signal (2 wire requiring excitation)

Current Signal (3 wire requiring excitation)

Terminal 3: +Volt supply
Terminal 6: +ADC (signal)
Terminal 8: -ADC (common)
Excitation Jumper: 18 V

Voltage Signal (3 wire requiring excitation)

Terminal 3: +Volt supply
Terminal 7: +VDC (signal)
Terminal 8: -VDC (common)
Excitation Jumper: 18 V

Resistance Signal (2 wire requiring excitation)

Terminal 3: Jumper to terminal 7
Terminal 7: Resistance
Terminal 8: Resistance
Excitation Jumper: 1 mA REF.

Potentiometer Signal (3 wire requiring excitation)

Terminal 3: High end of pot.
Terminal 7: Wiper
Terminal 8: Low end of pot.
Excitation Jumper: 2 V REF.
V/T Jumper: V
Input Range Jumper: 2 Volt
Module 1 Input Range: 2 Volt
Note: The Apply signal scaling style should be used because the signal will be in volts.

CAUTION: Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common; and the common of the isolated plug-in cards with respect to input common.

4.3 TEMPERATURE INPUT SIGNAL WIRING

Before connecting signal wires, verify the V/T Jumper is in the T position.

CAUTION: Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common; and the common of the isolated plug-in cards with respect to input common.
4.4 USER INPUT WIRING

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If not using User Inputs, then skip this section. Only the appropriate User Input terminal has to be wired.

**Sourcing Logic**

Terminals 9-10: + VDC through external switching device

Terminal 8: -VDC through external switching device

When the USrAct parameter is programmed to Hi, the user inputs of the meter are internally pulled down to 0 V with 20 KΩ resistance. The input is active when it is pulled low (<1.1 V).

**Sinking Logic**

Terminals 9-10: Connect external switching device between the appropriate User Input terminal and User Comm.

Terminal 8:

When the USrAct parameter is programmed to Lo, the user inputs of the meter are internally pulled up to +3.3 V with 22 KΩ resistance. The input is active when it is pulled low (<1.1 V).

4.5 SETPOINT (ALARMS) WIRING

4.6 SERIAL COMMUNICATION WIRING

4.7 ANALOG OUTPUT WIRING

See appropriate plug-in card bulletin for details.

5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

The PAX2A display consists of a large, 6-digit upper display referred to as Line 1 and a smaller 9-digit lower display referred to as Line 2. The upper display (Line 1) can be configured to show a single value, i.e., the main input reading, Min, Max, or total values. The lower display (Line 2) can be used to display several selectable values including; input value, Min, Max, Total or setpoint values. For these values the Mnemonics is shown in the left most digits of Line 2.

**KEY**

<table>
<thead>
<tr>
<th>KEY</th>
<th>DISPLAY MODE OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Index Line 2 through max/min/input/total readouts</td>
</tr>
<tr>
<td>P</td>
<td>Access the parameter and hidden display loops</td>
</tr>
<tr>
<td>F1</td>
<td>Function key 1; hold for 3 seconds for second function 1*</td>
</tr>
<tr>
<td>F2</td>
<td>Function key 2; hold for 3 seconds for second function 2*</td>
</tr>
</tbody>
</table>

*Factory setting for F1 and F2 is no mode

**PROGRAMMING MODE OPERATION**

<table>
<thead>
<tr>
<th>PROGRAMMING MODE OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick exit to display mode</td>
</tr>
<tr>
<td>Access the programming parameter menus, store selected parameter and index to next parameter</td>
</tr>
<tr>
<td>Increment selected parameter value</td>
</tr>
<tr>
<td>Decrement selected parameter value</td>
</tr>
</tbody>
</table>

The Programmable Units Display allows the user to access various parameters and operations through the use of the front buttons and display. The Display Line 1 and Display Line 2 provide different readouts depending on the mode selected. The Setpoint Annunciators indicate when setpoints are active.
PAX2A DISPLAY LOOPS

The PAX2A offers three display loops to allow users quick access to needed information. These display loops are available when the meter is in the normal display mode. By pressing the D key, the user can view parameters such as the total, Min, Max or the input in the Main Display Loop. Display selections are fully programmable and are viewed on the 9 digit line of the meter.

Pressing the P key with no security code (Code 0) will put the meter directly into the programming mode. When a security code is active (Code 1-255), pressing the P key will allow access to the Parameter Display Loop. This loop is where the parameters like setpoint values are normally put for general public access. Parameters in this loop can only be viewed/changed if enabled in the meter programming. After all the parameters in the Parameter Display Loop are viewed, an additional press of the P key will bring up the security code (Code 0).

Access the Hidden Display Loop by entering the selected security code. In this loop all parameters can be changed. Combining the two parameter loops provides an area for parameters that require general access and/or protected or secure access depending on your application needs.

During programming of the meter you will need to select if a value is to be displayed or not. If the value is required, select the lock mode (LOC). If you decide to display the value, you will need to assign it to a loop; D for the Main Display Loop, P for the Parameter Display Loop, and H for the Hidden Display Loop. In the case of the parameters, such as the setpoint values you will also need to decide if the value can only be read (rEnt) or change/edit mode (Ent).

There are selections in the programming that allow for the values to be reset. When the P key is pushed on a resettable display, the unit will display the value mnemonic and “NO” (if Line 2 value was set for “P-ENT” or “d-ENT” in “3-dISPLY”). Pressing the UP and DN keys will toggle between “NO” and “YES”. Pressing the P key with “YES” displayed will cause the reset action to be performed.

The P, Parameter key is used to scroll among the programmed Line 2 parameter values when at the main display or to step through the parameter loop and hidden parameter loop. It is used as the enter key when the meter is in the programming mode.

Numerical Value Entry

The UP and DN arrow keys are used to change the parameter values in any of the display loops, if the parameter is programmed for the change mode. The UP and DN arrow keys will increment or decrement the parameter value. When the arrow key is pressed and held, the value automatically scrolls. The longer the arrow key is held the faster the value scrolls.

For large value changes, press and hold the UP or DN arrow key. While holding that arrow key, momentarily press the D key and the value scrolls by 1000’s as the arrow key is held. Releasing the arrow key removes the 1000’s scroll feature. The arrow keys can then be used to make small value changes as described above.
6.0 Programming The PAX2A
MODULE 1 - INPUT SETUP PARAMETERS (I-I INPUT)

**PARAMETER MENU**

- **Input Range** (200U 100A 10000A tc-t tc-E tc-d tc-E tc-R tc-S tc-b tc-n)
- **Temperature Scale**
  - °F
  - °C
- **Ice Point Compensation**
  - On
  - Off
- **ADC Conversion Rate (/SEC)**
  - 5 10 20 40 80 160
- **Display Decimal Point**
- **Display Rounding**
- **Display Offset**
- **Filter Setting**
- **Filter Band**
- **Scaling Points**
- **Scaling Style**
- **Input n Value**
- **Display n Value**

**INPUT RANGE**

Select the desired input range.

**TEMPERATURE SCALE**

For TC and RTD Input Range Selection only.

Select the temperature scale. This selection applies for Input, MAX, MIN, and TOT displays. If changed, those parameters that relate to the temperature scale should be checked. This selection is not available for custom sensor types.

**ICE POINT COMPENSATION**

For TC Input Range Selection only.

This parameter turns the internal ice point compensation on or off. Normally, the ice point compensation is on. If using external compensation, set this parameter to off. In this case, use copper leads from the external compensation point to the meter.

**ADC CONVERSION RATE (/SEC)**

Select the ADC conversion rate (conversions per second). Temperature inputs can not be set higher than 20 updates per second. The selection does not affect the display update rate, however it does affect setpoint and analog output response time. The default factory setting of 5 is recommended for most applications. Selecting a fast update rate may cause the display to appear very unstable.

**DECIMAL RESOLUTION**

Select desired display resolution. The available selections are dependent on the Input Type selected (°F/°C).

**Rounding Increment**

Rounding selections other than one, cause the Input Display to ‘round’ to the nearest rounding increment selected (ie. rounding of ‘5’ causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Input Display. Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection.

**Display Offset**

The display can be corrected with an offset value. This can be used to compensate for probe errors, errors due to variances in probe placement or adjusting the readout to a reference thermometer. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the affects of offset.

**Digital Filtering**

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of ‘0’ disables filtering.

**Filter Band**

The digital filter will adapt to variations in the input signal. The filter engages when the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the digital filter permanently engaged.

**Scaling Points**

Linear - Scaling Points (2)

For linear processes, only 2 scaling points are necessary. It is recommended that the 2 scaling points be at opposite ends of the input signal being applied. The points do not have to be the signal limits. Display scaling will be linear.
between and continue past the entered points up to the limits of the Input Signal Jumper position. Each scaling point has a coordinate-pair of Input Value (INPUtn) and an associated desired Display Value (dSLGR n).

**Nonlinear - Scaling Points (Greater than 2)**

For non-linear processes, up to 16 scaling points may be used to provide a piece-wise linear approximation. (The greater the number of scaling points used, the greater the conformity accuracy.) The Input Display will be linear between scaling points that are sequential in program order. Each scaling point has a coordinate-pair of Input Value (INPUtn) and an associated desired Display Value (dSLGR n). Data from tables or equations, or empirical data could be used to derive the required number of segments and data values for the coordinate pairs. In the Crimson software, several linearization equations are available.

**SCALING STYLE**

This parameter does not apply for thermocouple or RTD input ranges.

![SCALING STYLE](Key-in data - Apply key-in data)

If Input Values and corresponding Display Values are known, the Key-in (KEY) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be used from the actual input signal source or simulator, the Apply (APPLY) scaling style must be used.

**INPUT VALUE FOR SCALING POINT 1**

![INPUT VALUE FOR SCALING POINT 1](- 199999 to 999999)

For Key-in (KEY), enter the known first Input Value by using the arrow keys. (The Input Range selection sets up the decimal location for the Input Value). For Apply (APPLY), the existing programmed value will appear. If this is acceptable, press the P key to save and continue to the next parameter. If the actual signal is required, apply signal, press DN key and the actual signal value will be displayed. Then press the P key to accept this value and continue to the next parameter.

**DISPLAY VALUE FOR SCALING POINT 1**

![DISPLAY VALUE FOR SCALING POINT 1](- 199999 to 999999)

Enter the first coordinating Display Value by using the arrow keys. This is the same for KEY and APPLY scaling styles. The decimal point follows the same for same for KEY and APPLY scaling styles. The decimal point follows the value.

**INPUT VALUE FOR SCALING POINT 2**

![INPUT VALUE FOR SCALING POINT 2](10000 to 999999)

For Key-in (KEY), enter the known second Input Value by using the arrow keys. For Apply (APPLY), adjust the signal source externally until the next desired Input Value appears. (Follow the same procedure if using more than 2 scaling points.) These bottom selections are not available for the TC or RTD Input ranges.

**DISPLAY VALUE FOR SCALING POINT 2**

![DISPLAY VALUE FOR SCALING POINT 2](10000 to 999999)

Enter the second coordinating Display Value by using the arrow keys. This is the same for KEY and APPLY scaling styles. (Follow the same procedure if using more than 2 scaling points.)

**ENABLE SCALE LIST**

When enabled, a second list of scaling points is active in the selected parameter list for List A and List B.

---

**MODULE 2 - USER INPUT/ FUNCTION KEY PARAMETERS (2-FUNCt)**

The two user inputs are individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed the instant the user input transitions to the active state. The front panel function keys, F1 and F2, are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed the instant the key is pressed. Holding the function key for three seconds executes a secondary function. It is possible to program a secondary function without a primary function.

In most cases, if more than one user input and/or function key is programmed for the same function, the maintained (level trigger) actions will be performed while at least one of those user inputs or function keys are activated. The momentary (edge trigger) actions will be performed every time any of those user inputs or function keys transition to the active state.

Note: In the following explanations, not all selections are available for both user inputs and front panel function keys. Displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection. User Key will represent both user inputs. F1 will represent both function keys.
NO FUNCTION

No function is performed if activated. This is the factory setting for all user inputs and function keys. No function can be selected without affecting basic startup.

PROGRAMMING MODE LOCK-OUT

Programming Mode is locked-out, as long as activated (maintained action). A security code can be configured to allow programming access during lock-out.

ZERO (TARE) DISPLAY

The Zero (Tare) Display provides a way to zero the Input Display value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), \( r \text{ESE} \) flashes and the Display is set to zero. At the same time, the Display value (that was on the display before the Zero Display) is subtracted from the Display Offset Value and is automatically stored as the new Display Offset Value. If another Zero (tare) Display is performed, the display will again change to zero and the Display reading will shift accordingly.

RELATIVE/ABSOLUTE DISPLAY

This function will switch the Input Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input Display will normally show the Relative unless switched by this function. Regardless of the display selected, all meter functions continue to operate based on relative values. The Absolute is a gross value (based on Module 1 DSP and INP entries) without the Display Offset Value. The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the input display switches back to Relative display. \( \text{D} \text{bEl} \) or \( r \text{EL} \) is momentarily displayed at transition to indicate which display is active.

HOLD DISPLAY

The shown display is held but all other meter functions continue as long as activated (maintained action).

HOLD ALL FUNCTIONS

The meter disables processing the input, holds all display contents, and locks the state of all outputs as long as activated (maintained action). The serial port continues data transfer.

SYNCHRONIZE METER READING

The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D with other processes or timing events.

STORE BATCH READING IN TOTALIZER

The Input Display value is one time added (batched) to the Totalizer at transition to activate (momentary action) and Line 2 flashes \( b \text{At} \). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. When this function is selected, the normal operation of the Totalizer is overridden.

SELECT TOTALIZER DISPLAY

The Totalizer display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The D key overrides the active user input. The Totalizer continues to function including associated outputs independent of being displayed.

RESET TOTALIZER

When activated (momentary action), \( r \text{ESE} \) flashes and the Totalizer resets to zero. The Totalizer then continues to operate as it is configured. This selection functions independent of the selected display.

RESET AND ENABLE TOTALIZER

When activated (momentary action), \( r \text{ESE} \) flashes and the Totalizer resets to zero. The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

ENABLE TOTALIZER

The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

SELECT MAXIMUM DISPLAY

The Maximum display appears on Line 2 as long as activated (maintained action). The H annunciator identifies the Maximum display value. When the user input is released, the Maximum display is removed from Line 2. The D or P keys override the active user input. The Maximum continues to function independent of being displayed.

RESET MAXIMUM DISPLAY

When activated (momentary action), \( r \text{ESE} \) flashes and the Maximum resets to the present Input Display value. The Maximum function then continues from that value. This selection functions independent of the selected display.

SELECT MINIMUM DISPLAY

The Minimum display appears on Line 2 as long as activated (maintained action). The L annunciator identifies the Minimum display value. When the user input is released, the Minimum display is removed from Line 2. The D or P keys override the active user input. The Minimum continues to function independent of being displayed.
**RESET MINIMUM DISPLAY**

When activated (momentary action), \( \text{RESET} \) flashes and the Minimum resets to the present Input Display value. The Minimum function then continues from that value. This selection functions independent of the selected display.

**RESET MAXIMUM AND MINIMUM DISPLAY**

When activated (momentary action), \( \text{RESET} \) flashes and the Maximum and Minimum readings are set to the present Input Display value. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.

**DISPLAY SELECT**

When activated (momentary action), Line 2 advances to the next display that is not locked out from the Display Mode.

**ADJUST DISPLAY INTENSITY**

When activated (momentary action), the display intensity changes to the next intensity level (of 5). The intensity level, when changed via the User Input/Function Key, is not retained at power-down, unless Quick Programming or Full Programming mode is entered and exited. The meter will power-up at the last saved intensity level.

**CHANGE DISPLAY COLOR**

When activated (momentary action), Line 1 will change color.

**SELECT PARAMETER LIST**

Two lists of input scaling points and setpoint values (including band and deviation) are available. The two lists are named \( \text{LIST-A} \) and \( \text{LIST-B} \). If a user input is used to select the list then \( \text{LIST-A} \) is selected when the user input is not active and \( \text{LIST-B} \) is selected when the user input is active (maintained action). If a front panel key is used to select the list then the list will toggle for each key press (momentary action). The display will only indicate which list is active when the list is changed. To program the values for \( \text{LIST-A} \) and \( \text{LIST-B} \), first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the desired values for the input scaling points and SP1, SP2, SP3, and SP4, if used. If any other parameters are changed then the other list values must be reprogrammed.

**SETPOINT SELECTIONS**

The following selections are functional only with a Setpoint plug-in card installed.

- \( \text{LIST} \) - Select main or alternate setpoints
- \( \text{r-1} \) - Reset Setpoint 1 (Alarm 1)
- \( \text{r-2} \) - Reset Setpoint 2 (Alarm 2)
- \( \text{r-3} \) - Reset Setpoint 3 (Alarm 3)
- \( \text{r-4} \) - Reset Setpoint 4 (Alarm 4)
- \( \text{r-34} \) - Reset Setpoint 3 & 4 (Alarm 3 & 4)
- \( \text{r-234} \) - Reset Setpoint 2, 3 & 4 (Alarm 2, 3 & 4)
- \( \text{r-ALL} \) - Reset All Setpoints (Alarms 1-4)

**PRINT REQUEST**

The meter issues a block print through the serial port when activated, and the serial type is set to \( \text{rLC} \). The data transmitted during a print request and the serial type is programmed in Module 7. If the user input is still active after the transmission is complete (about 100 msec), an additional transmission occurs. As long as the user input is held active, continuous transmissions occur.
Module 3 is the programming of the Main Display loop, Parameter display loop (quick programming) access or lock-out, Hidden parameter loop, and Full programming lock-out. The large upper display line value is configured by the "L dL Ply" parameter. The Units mnemonic can be used to assign user units or a custom display mnemonic to the upper display value. When in the main display loop, the available Line 2 displays (items configured for d-lev or d-cont) can be consecutively read on lower display by repeatedly pressing the D key. A justified 3 character mnemonic indicates which parameter value is being shown on the lower display. When in the main display loop the User keys F1 and F2 function as programmed in Module 2.

The Parameter display loop items can be accessed by pressing the P key. To edit a main display line item, that is configured as d-ent, the P key is pushed and the unit enters a parameter edit mode in which the Up/F1 and Dn/F2 key increments or decrements the value. "Full" Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input.

**LINE 1 DISPLAY COLOR**

Enter the desired Line 1 display color.

**DISPLAY INTENSITY LEVEL**

Enter the desired Display Intensity Level (0-4) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

**DISPLAY CONTRAST LEVEL**

Enter the desired Display Contrast Level (0-15) by using the arrow keys. The display contrast / viewing angle will actively move up or down as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

**LINE 1 DISPLAY**

Select the value to be assigned to the primary or top line of the meter display.

**UNITS MNEMONIC**

This parameter activates the Units Indicator on the display. There are two methods of selecting the Indicator. List will present a group of Units preprogrammed into the meter. Segments allows the user to choose which of the segments should light, however they can only be programmed via Crimson programming software.

**LINE 2 MAIN, SECONDARY & HIDDEN DISPLAY LOOP ACCESSIBLE ITEMS**

Select YES to program the display Line 2 accessible values. The default setting of NO bypasses the programming of these values to shorten the module. All of the individual Line 2 settings are retained. The following values can be made accessible on Line 2 of the Main Display (D key), Parameter (P key) and Hidden (P key following code entry) loops. Each of the following parameters can be configured for one of the following settings. Not all selections are available for each parameter.

**LINE 2 INPUT, TOTAL, MIN & MAX ACCESS**

When configured for d-ent or P-ent, the value is resettable. To reset the value, push the P key when viewing the value. "r S-EYES" will be displayed at which point the, up key can be pressed so that the display shows "S-YES". Pressing the P key again will initiate the reset action.

**LINE 2 PARAMETER LIST A/B ACCESS**

See User Functions "Select Parameter List" for a description of the list function. The Line 2 Parameter List provides a means of setting or viewing the active parameter list.
LINE2 SETPOINTS ACCESS

When configured for d-ENT, the P key must be pushed to select the item for change before the UP/F1 and DN/F2 keys will increment or decrement the value.

LINE2 PARAMETER & HIDDEN DISPLAY LOOP ACCESSIBLE ITEMS

The following values can be made accessible on Line 2 in the Parameter (P key) and Hidden (P key following code entry) loops. They cannot be made accessible in the Main Display loop (D key). They can be configured for the following settings:

LINE 1 DISPLAY COLOR ACCESS

DISPLAY INTENSITY ACCESS

DISPLAY CONTRAST ACCESS

LINE2 USER FUNCTIONS ACCESSIBLE ITEMS

Select YES to display the following list of User functions that can be made available at the end of the Secondary or Hidden display loops. The more critical and frequently used Functions should be first assigned to the User Inputs and User Function keys. If more functions are needed than what can be obtained with User Inputs, this feature will provide a means to provide that access. Refer to module 2, 2-FNC for a description of the function.

PROGRAMMING SECURITY CODE

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (PLOC) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only the Setpoint values to be modified, but allows direct access to these values without having to enter Full Programming mode.

Programming a Security Code other than 0, requires this code to be entered at the COdE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the COdE prompt appears (see chart).

<table>
<thead>
<tr>
<th>SECURITY CODE</th>
<th>USER INPUT CONFIGURED</th>
<th>USER INPUT STATE</th>
<th>WHEN KEY IS PRESSED</th>
<th>FULL PROGRAMMING MODE ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>not PLOC</td>
<td>Full Programming</td>
<td>Immediate Access</td>
<td></td>
</tr>
<tr>
<td>&gt;0</td>
<td>not PLOC</td>
<td>Quick Programming</td>
<td>After Quick</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Programming w/Display Intensity</td>
<td></td>
</tr>
<tr>
<td>&gt;0</td>
<td>PLOC</td>
<td>Active</td>
<td>Quick Programming</td>
<td>After Quick Programming</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>w/Display Intensity</td>
<td>with correct code # at COdE prompt.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>PLOC</td>
<td>Not Active</td>
<td>Full Programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Immediate Access</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>PLOC</td>
<td>Active</td>
<td>Quick Programming</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>PLOC</td>
<td>Not Active</td>
<td>Full Programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Immediate Access</td>
<td></td>
</tr>
</tbody>
</table>

Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming (all meter parameters are accessible).
**MODULE 4 - SECONDARY FUNCTION PARAMETERS (4-SCNdry)**

**PARAMETER MENU**

- **MAX Capture Assignment**
  - **HI-AS REL SEC**
  - **LO-AS REL SEC**
  - **dSP-t SEC**

- **MIN Capture Assignment**
  - **HI-t REL SEC**
  - **LO-t REL SEC**

**Display Update Rate**

- **HI-AS REL SEC**
  - **0.0 to 3275.0 seconds**

MAX CAPTURE ASSIGNMENT

Select the desired parameter that will be assigned to the Max Capture.

MAX CAPTURE DELAY TIME

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

MIN CAPTURE ASSIGNMENT

Select the desired parameter that will be assigned to the Min Capture.

MIN CAPTURE TIME

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

DISPLAY UPDATE RATE

This parameter configures the display update rate. It does not affect the response time of the setpoint output or analog output option cards.
The totalizer accumulates (integrates) the Input Display value using one of two modes. The first is using a time base. This can be used to compute a time temperature product. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used to provide a readout of temperature integration, useful in curing and sterilization applications. If the Totalizer is not needed, its display can be locked-out and this module can be skipped during programming.

**TOTALIZER DECIMAL POINT**

For most applications, this matches the Input Display Decimal Point (\(dECPN\)). If a different location is desired, refer to Totalizer Scale Factor.

**TOTALIZER TIME BASE**

\[ \text{Time Base} = \begin{cases} \text{sec} & \text{seconds} \\ \text{min} & \text{minutes} \\ \text{hr} & \text{hours} \\ \text{d} & \text{days} \end{cases} \]

This is the time base used in Totalizer accumulations. If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

**TOTALIZER SCALE FACTOR**

For most applications, the Totalizer reflects the same decimal point location and engineering units as the Input Display. Common possibilities are:

1. Changing decimal point location (example tenths to whole)
2. Average over a controlled time frame.

Details on calculating the scale factor are shown later.

**TOTALIZER LOW CUT VALUE**

\[ \text{Lo Cut} = \begin{cases} -199999 & \text{to} \ 999999 \end{cases} \]

A low cut value disables Totalizer when the Input Display value falls below the value programmed.

**TOTALIZER POWER UP RESET**

\[ \text{PWRUP} = \begin{cases} \text{NO} & \text{- do not reset buffer} \\ \text{YES} & \text{- reset buffer} \end{cases} \]

The Totalizer can be reset to zero on each meter power-up by setting this parameter to reset.

**TOTALIZER BATCHING**

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (\(bAt\)). In this mode, when the user input or function key is activated, the Input Display reading is one time added to the Totalizer (batch). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. This is useful in weighing operations, when the value to be added is not based on time but after a filling event.

**TOTALIZER USING TIME BASE**

Totalizer accumulates as defined by:

\[ \frac{\text{Input Display} \times \text{Totalizer Scale Factor}}{\text{Totalizer Time Base}} \]

Where:

- Input Display - the present input reading
- Totalizer Scale Factor - 0.001 to 65.000
- Totalizer Time Base - (the division factor of \(tBASE\))

Example: The input reading is at a constant rate of 10.0 gallons per minute. The Totalizer is used to determine how many gallons in tenths has flowed. Because the input Display and Totalizer are both in tenths of gallons, the Totalizer Scale Factor is 1. With gallons per minute, the Totalizer Time Base is minutes (60). By placing these values in the equation, the Totalizer will accumulate every second as follows:

\[ 10.0 \times 1.000 = 0.1667 \text{ gallon accumulates each second} \]

This results in:

- 10.0 gallons accumulates each minute
- 600.0 gallons accumulates each hour

**TOTALIZER SCALE FACTOR CALCULATION EXAMPLES**

1. When changing the Totalizer Decimal Point (\(dECPN\)) location from the Input Display Decimal Point (\(dECPN\)), the required Totalizer Scale Factor is multiplied by a power of ten.

Example:

\[
\begin{array}{|c|c|c|}
\hline
\text{Input} & \text{Input} & \text{Input} \\
(\text{dECPN}) & (\text{dECPN}) & (\text{dECPN}) \\
0 & 0 & 0 \\
0 & 0 & 0 \\
x10 & 0.1 & x10 \\
x100 & 0.01 & x100 \\
x1000 & 0.001 & x1000 \\
\hline
\text{Scale Factor} & \text{Scale Factor} & \text{Scale Factor} \\
10 & 10 & 10 \\
1 & 1 & 1 \\
0.1 & 0.1 & 0.1 \\
0.01 & 0.01 & 0.01 \\
0.001 & 0.001 & 0.001 \\
\hline
\end{array}
\]

\((x = \text{Totalizer display is round by tens or hundreds})\)

2. To obtain an average reading within a controlled time frame, the selected Totalizer Time Base is divided by the given time period expressed in the same timing units.

Example: Average temperature per hour in a 4 hour period, the scale factor would be 0.250. To achieve a controlled time frame, connect an external timer to a user input programmed for \(r\text{BASE}\). The timer will control the start (reset) and the stopping (hold) of the totalizer.
Enter the setpoint (alarm output) to be programmed. The “n” in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display will return to NO. Repeat step for each setpoint to be programmed. The NO chosen at SELECT, will return to Pro NO. The number of setpoints available is setpoint output card dependent.

Selects the meter value to be used to trigger the Setpoint Alarm. The rEl setting will cause the setpoint to trigger off of the relative (net) input value. The Ab setting will cause the setpoint to trigger off of the absolute (gross) input value. The absolute input value is based on Module 1 dSP and tP entries.

Enter desired hysteresis value. See Setpoint Alarm Figures for visual explanation of how setpoint alarm actions (balance and unbalance) are affected by the hysteresis. When the setpoint is a control output, usually balance hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high acting setpoints and functions on the high side for low acting setpoints. Note: Hysteresis eliminates output chatter at the switch point, while time delay can be used to prevent false triggering during process transient events.

Enter the output logic of the alarm output. The nor logic leaves the output operation as normal. The rEU logic reverses the output logic. In rEU, the alarm states in the Setpoint Alarm Figures are reversed.
**RESET ACTION**

\[
\text{Reset Action: } \begin{cases} 
\text{Auto} & \text{Auto} \\
\text{Latch 1} & \text{Latch 1} \\
\text{Latch 2} & \text{Latch 2} \\
\end{cases}
\]

Enter the reset action of the alarm output.

- **Auto** = Automatic action; This action allows the alarm output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Alarm Figures. The “on” alarm may be manually reset (off) immediately by a front panel function key or user input. The alarm remains reset off until the trigger point is crossed again.

- **Latch 1** = Latch with immediate reset action; This action latches the alarm output on at the trigger point per the Setpoint Action shown in Setpoint Alarm Figures. Latch means that the alarm output can only be turned off by front panel function key or user input manual reset, serial reset command or meter power cycle. When the user input or function key is activated (momentary or maintained), the corresponding “on” alarm output is reset immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

- **Latch 2** = Latch with delay reset action; This action latches the alarm output on at the trigger point per the Setpoint Action shown in Setpoint Alarm Figures. Latch means that the alarm output can only be turned off by front panel function key or user input manual reset, serial reset command or meter power cycle. When the user input or function key is activated (momentary or maintained), the meter delays the event until the corresponding “on” alarm output crosses the trigger off point. (Previously latched alarms are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous Latch 2 reset if it is not activated at power up.)

**STANDBY OPERATION**

- **No**
- **Yes**

When **Yes**, the alarm is disabled (after a power up) until the trigger point is crossed. Once the alarm is on, the alarm operates normally per the Setpoint Action and Reset Mode.

**SETPOINT ANNUNCIATOR**

- **No**
- **Red Flash**
- **Off**

The **Off** mode disables display setpoint annunciators. The **No** mode displays the corresponding setpoint annunciators of “on” alarm outputs. The **Red Flash** mode displays the corresponding setpoint annunciators of “off” alarm outputs. The **Red Flash** mode flashes the corresponding setpoint annunciators of “on” alarm outputs.

**CHANGE COLOR**

- **No**
- **Red**
- **Orange**
- **Green**

Select the desired communications protocol. Modbus is preferred as it provides access to all meter values and parameters. Since the Modbus protocol is included within the PAX2, the PAX Modbus option card, PAXCDC4, should not be used. The PAXCDC1 (RS485), or PAXCDC2 (RS232) card should be used instead.

<table>
<thead>
<tr>
<th><strong>MODULE 7 - SERIAL COMMUNICATIONS PARAMETERS</strong></th>
<th><strong>PARAMETER MENU</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USB SETUP</strong></td>
<td><strong>CONFIG Port</strong></td>
</tr>
<tr>
<td><strong>BAUD RATE</strong></td>
<td><strong>Setpoint</strong></td>
</tr>
<tr>
<td><strong>DATA BIT</strong></td>
<td><strong>Parity</strong></td>
</tr>
<tr>
<td><strong>PARITY BIT</strong></td>
<td><strong>Color</strong></td>
</tr>
<tr>
<td><strong>COMMUNICATIONS TYPE</strong></td>
<td><strong>Transmission</strong></td>
</tr>
<tr>
<td><strong>COMMENTS</strong></td>
<td><strong>Port</strong></td>
</tr>
</tbody>
</table>

To set the baud rate of the serial communications equipment on the serial link. Normally, the baud rate is set to the highest value that all the serial equipment are capable of transmitting and receiving.

**Setpoint Action**

Select either 7 or 8 bit data word lengths. Set the word length to match the other serial communications equipment on the serial link.

**Parity Bit**

Select the desired parity mode of the serial communications equipment on the serial link. The meter ignores the parity when receiving data and sets the parity bit for outgoing data. If no parity is selected with 7 bit word length, an additional stop bit is used to force the frame size to 10 bits.
SERIAL COMMUNICATIONS

The PAX2A supports serial communications using the optional serial communication cards or via the USB programming port located on the side of the unit. When USB is being used (connected), the serial communication card is disabled. The PAX2A supports both the RLC protocol and also supports ModBus communications using the standard RS232 and RS485 Pax option cards. The Pax ModBus option card should not be used with the PAX2A, as the PAX2A internal ModBus protocol supports complete unit configuration, and is much more responsive.

USB

The USB programming port is primarily intended to be used to configure the PAX2A with the Crimson programming software. It can also however, be used as a virtual serial communications port following installation of the PAX2A USB drivers that are supplied with the Crimson software. When the USB port is being used, i.e. the USB cable is connected between PAX2A and PC, all serial communications with the serial option card (if used) is disabled.

USB Cable type required: USB A to Mini-B (not supplied)

PAX2A CONFIGURATION USING CRIMSON AND USB

1. Install Crimson software and drivers.
2. Supply power to PAX2A
3. Insure “USB” parameter in module 7-SERIAL, is set to “CONF16” (factory default setting).
4. Attach USB A – MiniB cable between PC and PAX2A
5. Create a new (File, New) or open an existing PAX2A database within Crimson.
6. Configure Crimson 2 Link, Options to ...

SERIAL MODBUS COMMUNICATIONS

Modbus Communications requires that the Serial Communication Type Parameter (TPRE) be set to "MBRTU" or "MBASC".

PAX2A CONFIGURATION USING CRIMSON AND SERIAL

COMMUNICATIONS CARD

1. Install Crimson software.
2. Install RS232 or RS485 card and connect communications cable from PAX2A to PC.
3. Supply power to PAX2A
4. Configure serial parameters in 1-SERIAL, to MBRTU, 38,400 baud, address 247.
5. Create a new (File, New) or open an existing PAX2A database within Crimson.
6. Configure Crimson 2 Link, Options to serial port to which cable is attached (in step 2).

SUPPORTED FUNCTION CODES

FC03: Read Holding Registers
1. Up to 32 registers can be requested at one time.
2. HEX <8000> is returned for non-used registers.

FC04: Read Input Registers
1. Up to 32 registers can be requested at one time.
2. Block starting point can not exceed register boundaries.
3. HEX <8000> is returned in registers beyond the boundaries.
4. Input registers are a mirror of Holding registers.

FC06: Preset Single Register
1. HEX <8001> is echoed back when attempting to write to a read only register.
2. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit. It is also returned in the response.

FC16: Preset Multiple Registers
1. No response is given with an attempt to write to more than 32 registers at a time.
2. Block starting point cannot exceed the read and write boundaries (40001-XXXX).
3. If a multiple write includes read only registers, then only the write registers will change.
4. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit.

**FC08: Diagnostics**
The following is sent upon FC08 request:
Module Address, 08 (FC code), 04 (byte count), “Total Comms” 2 byte count, “Total Good Comms” 2 byte count, checksum of the string
“Total Comms” is the total number of messages received that were addressed to the PAX2. “Total Good Comms” is the total messages received by the PAX2 with good address, parity and checksum. Both counters are reset to 0 upon response to FC08 and at power-up.

**FC17: Report Slave ID**
The following is sent upon FC17 request:
RLC-PAX2A ab<0100h><20h><20h><10h>

\[a = \text{SP Card, } “0”:\text{-No SP, } “2” \text{ or } “4” \text{ SP}
\]
\[b = \text{Linear Card } “0” = \text{None, } “1” = \text{Yes}
\]
\[<18h>\text{Max Register Reads (24)}
\]
\[<18h>\text{Max Register Writes (24)}
\]
\[<0100>\text{Software Version Number (1.00)}
\]

**SUPPORTED EXCEPTION CODES**
01: Illegal Function
Issued whenever the requested function is not implemented in the meter.

02: Illegal Data Address
Issued whenever an attempt is made to access a single register that does not exist (outside the implemented space) or to access a block of registers that falls completely outside the implemented space.

03: Illegal Data Value
Issued when an attempt is made to read or write more registers than the meter can handle in one request.

07: Negative Acknowledge
Issued when a write to a register is attempted with an invalid string length.

**PAX2A MODBUS REGISTER TABLE**
The below limits are shown as Integers or HEX <> values. Read and write functions can be performed in either Integers or Hex as long as the conversion was done correctly. Negative numbers are represented by two’s complement.

Note 1: The PAX2A should not be powered down while parameters are being changed. Doing so may corrupt the non-volatile memory resulting in checksum errors.

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT</th>
<th>HIGH LIMIT</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001</td>
<td>Input Relative Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process value of present input level. This value is affected by Input Type, Resolution, Scaling, &amp; Offset Value. (Relative Value = Absolute Input Value + Offset Value)</td>
</tr>
<tr>
<td>40002</td>
<td>Input Relative Value (Lo word)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40003</td>
<td>Maximum Value (Hi word)</td>
<td>-199999</td>
<td>999999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40004</td>
<td>Maximum Value (Lo word)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40005</td>
<td>Minimum Value (Hi word)</td>
<td>-199999</td>
<td>999999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40006</td>
<td>Minimum Value (Lo word)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40007</td>
<td>Total Value (Hi word)</td>
<td>-19999999</td>
<td>9999999999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40008</td>
<td>Total Value (Lo word)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40009</td>
<td>Setpoint 1 Value (Hi word)</td>
<td>-199999</td>
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<td>100</td>
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<tr>
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</tr>
<tr>
<td>40016</td>
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<td>0</td>
<td>Read/Write</td>
<td>Active List (A or B). Applicable only for Band or Deviation Setpoint Action.</td>
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<td>Active List (A or B). Applicable only for Band or Deviation Setpoint Action.</td>
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<td>Read/Write</td>
<td>Active List (A or B). Applicable only for Band or Deviation Setpoint Action.</td>
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<tr>
<td>40024</td>
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<tr>
<td>40025</td>
<td>Setpoint Output Register (SOR)</td>
<td>0</td>
<td>15</td>
<td>N/A</td>
<td>Read/Write</td>
<td>Status of Setpoint Outputs. Bit State: 0 = Off, 1 = On. Bit 3 = S1, Bit 2 = S2, Bit 1 = S3, Bit 0 = S4. Outputs can only be activated/reset with this register when the respective bits in the Manual Mode Register (MMR) are set.</td>
</tr>
<tr>
<td>40026</td>
<td>Manual Mode Register (MMR)</td>
<td>0</td>
<td>31</td>
<td>0</td>
<td>Read/Write</td>
<td>Bit State: 0 = Auto Mode, 1 = Manual Mode Bit 4 = S1, Bit 3 = S2, Bit 2 = S3, Bit 1 = S4, Bit 0 = Linear Output</td>
</tr>
<tr>
<td>40027</td>
<td>Reset Output Register</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>Read/Write</td>
<td>Bit State: 1 = Reset Output, bit is returned to zero following reset processing; Bit 3 = S1, Bit 2 = S2, Bit 1 = S3, Bit 0 = S4</td>
</tr>
<tr>
<td>40028</td>
<td>Analog Output Register (AOR)</td>
<td>0</td>
<td>4095</td>
<td>0</td>
<td>Read/Write</td>
<td>Functional only if Linear Output is in Manual Mode. (MMR bit 0 = 1) Linear Output Card written to only if Linear Out (MMR bit 0) is set.</td>
</tr>
<tr>
<td>40029</td>
<td>Input Absolute Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Gross value of present Input level. This value is affected by Input Type, Resolution, Scaling, but not affected by Offset Value</td>
</tr>
<tr>
<td>40030</td>
<td>Input Absolute Value (Lo word)</td>
<td>N/A</td>
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<td>N/A</td>
<td>Read Only</td>
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<td>40031</td>
<td>Input Offset Value (Hi word)</td>
<td>-199999</td>
<td>999999</td>
<td>0</td>
<td>Read/Write</td>
<td>Relative Input Value (standard meter value) is sum of Input Offset Value and Input Absolute Value</td>
</tr>
<tr>
<td>40032</td>
<td>Input Offset Value (Lo word)</td>
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### Input Parameters

<table>
<thead>
<tr>
<th>Register Address</th>
<th>Register Name</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>Factory Setting</th>
<th>Access</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>40081</td>
<td>Input Range</td>
<td>0</td>
<td>26</td>
<td>10</td>
<td>Read/Write</td>
<td>0 = 250μA, 5 = 250mV, 11 = 100Ω, 17 = TC-K, 23 = RTD 385</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td>1 = 2.5mA, 6 = 2V, 12 = 1KΩ, 18 = TC-R, 24 = RTD 392</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>2 = 25mA, 7 = 10V, 13 = 10KΩ, 19 = TC-S, 25 = RTD 672</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>3 = 250mA, 8 = 25V, 14 = TC-T, 20 = TC-B, 26 = RTD 427</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 = 2A, 9 = 100V, 15 = TC-N, 21 = TC-J, 22 = TC-C</td>
</tr>
<tr>
<td>40082</td>
<td>Temperature Scale</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = °C, 1 = °F</td>
</tr>
<tr>
<td>40083</td>
<td>Ice Point Compensation</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = Off, 1 = On</td>
</tr>
<tr>
<td>40084</td>
<td>ADC Conversion Rate</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = 5, 1 = 10, 2 = 20, 3 = 40, 4 = 80, 5 = 160</td>
</tr>
<tr>
<td>40085</td>
<td>Decimal Point</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>Read/Write</td>
<td>0 = 0, 1 = 0, 2 = 0.00, 3 = 0.000, 4 = 0.000</td>
</tr>
<tr>
<td>40086</td>
<td>Rounding Factor</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = 1, 2 = 2, 5 = 3, 10 = 4, 20, 5 = 50, 6 = 100</td>
</tr>
<tr>
<td>40087</td>
<td>Digital Input Filter</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40088</td>
<td>Filter Band</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1 = 1 display unit</td>
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<tr>
<td>40089</td>
<td>Input Scaling Points</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes</td>
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#### Input Scaling Points Parameters

**List A**

<table>
<thead>
<tr>
<th>Register Address</th>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Access</th>
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<tr>
<td>40101</td>
<td>Number of Scaling Points</td>
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<td>40102</td>
<td>Reserved</td>
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<td>N/A</td>
<td>N/A</td>
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<td>Read/Write</td>
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<td>40106</td>
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<td>-199999</td>
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**List B**

<table>
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<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
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<td>Input Scaling Points</td>
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#### Setpoint Values

<table>
<thead>
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<th>Register Address</th>
<th>Parameter</th>
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<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Access</th>
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<tbody>
<tr>
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#### User Input / Function Keys

**USER INPUT / FUNCTION KEYS**

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<td>User F1 Key Action</td>
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**DISPLAY PARAMETERS**

SEE MODULE 3 FOR PARAMETER DESCRIPTIONS
<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT</th>
<th>HIGH LIMIT</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
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<tr>
<td>40334</td>
<td>Line 1 Display</td>
<td>0</td>
<td>8</td>
<td>1</td>
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<tr>
<td>40335</td>
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<td>0</td>
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<tr>
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<td>Units Digit 1 (Left)</td>
<td>0</td>
<td>46</td>
<td>0</td>
<td>Read/Write</td>
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<tr>
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<td>Units Digit 2 (Center)</td>
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<td>46</td>
<td>0</td>
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<td>Same selections as Digit 1</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
<td>40363</td>
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<td>Read/Write</td>
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<tr>
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<td>Line 2 Reset Max and Min Access</td>
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<td>2</td>
<td>0</td>
<td>Read/Write</td>
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</tr>
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<td>Line 2 Reset Alarm 1 Access</td>
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<td>2</td>
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<td>Read/Write</td>
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</tr>
<tr>
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<td>Line 2 Reset Alarm 2 Access</td>
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<td>0</td>
<td>Read/Write</td>
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</tr>
<tr>
<td>40367</td>
<td>Line 2 Reset Alarm 3 Access</td>
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<td>2</td>
<td>0</td>
<td>Read/Write</td>
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</tr>
<tr>
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<tr>
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<td>Line 2 Reset Alarm 3 and 4 Access</td>
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<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40370</td>
<td>Line 2 Reset Alarm 2, 3 and 4 Access</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40371</td>
<td>Line 2 Reset All Alarms (1-4) Access</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40372</td>
<td>Line 2 Print Request Access</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40373</td>
<td>Line 2 Security Code Value</td>
<td>0</td>
<td>250</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40381</td>
<td>Max (Hi) Capture Value Assignment</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40382</td>
<td>Max (Hi) Capture Delay Time</td>
<td>0</td>
<td>32750</td>
<td>10</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40383</td>
<td>Min (Lo) Capture Value Assignment</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40384</td>
<td>Min (Lo) Capture Delay Time</td>
<td>0</td>
<td>32750</td>
<td>10</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40385</td>
<td>Display Update (readings per second)</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40391</td>
<td>Totalizer Decimal Point</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40392</td>
<td>Totalizer Time Base</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40393</td>
<td>Totalizer Scale Factor</td>
<td>1</td>
<td>65000</td>
<td>1000</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40394</td>
<td>Totalizer Reset at Power Up</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40395</td>
<td>Totalizer Low Cut Value (Hi word)</td>
<td>-199999</td>
<td>999999</td>
<td>-199999</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40396</td>
<td>Totalizer Low Cut Value (Lo word)</td>
<td>-199999</td>
<td>999999</td>
<td>-199999</td>
<td>Read/Write</td>
<td></td>
</tr>
</tbody>
</table>

**SECONDARY PARAMETERS**

SEE MODULE 4 FOR PARAMETER DESCRIPTIONS

**TOTALIZER PARAMETERS**

SEE MODULE 5 FOR PARAMETER DESCRIPTIONS

**SETPOINT PARAMETERS**

SEE MODULE 6 FOR PARAMETER DESCRIPTIONS
<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT</th>
<th>HIGH LIMIT</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40405</td>
<td>Off Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40406</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Normal, 1 = Reverse</td>
</tr>
<tr>
<td>40407</td>
<td>Reset Action</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Auto, 1 = Latch1, 2 = Latch2</td>
</tr>
<tr>
<td>40408</td>
<td>Standby Operation</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes</td>
</tr>
<tr>
<td>40409</td>
<td>Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = Off, 1 = Normal, 2 = Reverse, 3 = Flash</td>
</tr>
<tr>
<td>40410</td>
<td>Color</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No Change, 1 = Green, 2 = Orange, 3 = Red, 4 = Grn/Org, 5 = Red/Org, 6 = Red/Grn, 7 = Line 1 Color</td>
</tr>
<tr>
<td>40411</td>
<td>Probe Failure Action (TC or RTD only)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Off, 1 = On (only applies for TC or RTD input)</td>
</tr>
<tr>
<td><strong>Setpoint 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40421</td>
<td>Assignment</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = None, 1 = Rel, 2 = Abs, 3 = Total</td>
</tr>
<tr>
<td>40422</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Ab-Hi, 2 = Ab-Lo, 3 = Au-Hi, 4 = Au-Lo, 5 = D-E-Hi, 6 = D-E-Lo, 7 = bANL, 8 = bNDnL, 9 = totLo, 10 = totHI</td>
</tr>
<tr>
<td>40423</td>
<td>Hysteresis Value</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1 = 1 Display Unit</td>
</tr>
<tr>
<td>40424</td>
<td>On Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40425</td>
<td>Off Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40426</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Normal, 1 = Reverse</td>
</tr>
<tr>
<td>40427</td>
<td>Reset Action</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Auto, 1 = Latch1, 2 = Latch2</td>
</tr>
<tr>
<td>40428</td>
<td>Standby Operation</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes</td>
</tr>
<tr>
<td>40429</td>
<td>Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = Off, 1 = Normal, 2 = Reverse, 3 = Flash</td>
</tr>
<tr>
<td>40430</td>
<td>Color</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No Change, 1 = Green, 2 = Orange, 3 = Red, 4 = Grn/Org, 5 = Red/Org, 6 = Red/Grn, 7 = Line 1 Color</td>
</tr>
<tr>
<td>40431</td>
<td>Probe Failure Action (TC or RTD only)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Off, 1 = On (only applies for TC or RTD input)</td>
</tr>
<tr>
<td><strong>Setpoint 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40441</td>
<td>Assignment</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = None, 1 = Rel, 2 = Abs, 3 = Total</td>
</tr>
<tr>
<td>40442</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Ab-Hi, 2 = Ab-Lo, 3 = Au-Hi, 4 = Au-Lo, 5 = D-E-Hi, 6 = D-E-Lo, 7 = bANL, 8 = bNDnL, 9 = totLo, 10 = totHI</td>
</tr>
<tr>
<td>40443</td>
<td>Hysteresis Value</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1 = 1 Display Unit</td>
</tr>
<tr>
<td>40444</td>
<td>On Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40445</td>
<td>Off Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40446</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Normal, 1 = Reverse</td>
</tr>
<tr>
<td>40447</td>
<td>Reset Action</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Auto, 1 = Latch1, 2 = Latch2</td>
</tr>
<tr>
<td>40448</td>
<td>Standby Operation</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes</td>
</tr>
<tr>
<td>40449</td>
<td>Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = Off, 1 = Normal, 2 = Reverse, 3 = Flash</td>
</tr>
<tr>
<td>40450</td>
<td>Color</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No Change, 1 = Green, 2 = Orange, 3 = Red, 4 = Grn/Org, 5 = Red/Org, 6 = Red/Grn, 7 = Line 1 Color</td>
</tr>
<tr>
<td>40451</td>
<td>Probe Failure Action (TC or RTD only)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Off, 1 = On (only applies for TC or RTD input)</td>
</tr>
<tr>
<td><strong>Setpoint 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40461</td>
<td>Assignment</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = None, 1 = Rel, 2 = Abs, 3 = Total</td>
</tr>
<tr>
<td>40462</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Ab-Hi, 2 = Ab-Lo, 3 = Au-Hi, 4 = Au-Lo, 5 = D-E-Hi, 6 = D-E-Lo, 7 = bANL, 8 = bNDnL, 9 = totLo, 10 = totHI</td>
</tr>
<tr>
<td>40463</td>
<td>Hysteresis Value</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1 = 1 Display Unit</td>
</tr>
<tr>
<td>40464</td>
<td>On Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40465</td>
<td>Off Time Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1 = 0.1 Second</td>
</tr>
<tr>
<td>40466</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Normal, 1 = Reverse</td>
</tr>
<tr>
<td>40467</td>
<td>Reset Action</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Auto, 1 = Latch1, 2 = Latch2</td>
</tr>
<tr>
<td>40468</td>
<td>Standby Operation</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes</td>
</tr>
<tr>
<td>40469</td>
<td>Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = Off, 1 = Normal, 2 = Reverse, 3 = Flash</td>
</tr>
<tr>
<td>40470</td>
<td>Color</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No Change, 1 = Green, 2 = Orange, 3 = Red, 4 = Grn/Org, 5 = Red/Org, 6 = Red/Grn, 7 = Line 1 Color</td>
</tr>
<tr>
<td>40471</td>
<td>Probe Failure Action (TC or RTD only)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Off, 1 = On (only applies for TC or RTD input)</td>
</tr>
<tr>
<td><strong>SERIAL COMMUNICATIONS PARAMETERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SEE MODULE 7 FOR PARAMETER DESCRIPTIONS</td>
</tr>
<tr>
<td>40481</td>
<td>USB Mode</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = Configuration, 1 = Port</td>
</tr>
<tr>
<td>40482</td>
<td>Type</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>Read/Write</td>
<td>0 = RLC Protocol (ASCII), 1 = Modbus RTU, 2 = Modbus ASCII</td>
</tr>
<tr>
<td>40483</td>
<td>Baud Rate</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>Read/Write</td>
<td>0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400</td>
</tr>
<tr>
<td>40484</td>
<td>Data Bits</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = 7 Bits, 1 = 8 Bits</td>
</tr>
<tr>
<td>40485</td>
<td>Parity</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = None, 1 = Even, 2 = Odd</td>
</tr>
<tr>
<td>40486</td>
<td>Address</td>
<td>0</td>
<td>99</td>
<td>247</td>
<td>Read/Write</td>
<td>RLC Protocol: 0-99, Modbus: 1-247</td>
</tr>
<tr>
<td>40487</td>
<td>Transmit Delay</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1 = 0.001 Second</td>
</tr>
<tr>
<td>40488</td>
<td>Abbreviated Transmission (RLC only)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes (Not used when communications type is Modbus)</td>
</tr>
</tbody>
</table>
SERIAL RLC PROTOCOL COMMUNICATIONS

RLC Communications requires the Serial Communications Type Parameter (tYPE) be set to “rLC”.

SENDING SERIAL COMMANDS AND DATA

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a the command terminator character * or $.

Command Chart

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Address Specifier</td>
<td>or two digit node address. Not required when address = 0.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit Value (read)</td>
<td>Read a register from the meter. Must be followed by register ID character.</td>
</tr>
<tr>
<td>V</td>
<td>Value Change (write)</td>
<td>Write to register or output. Must be followed by register ID character.</td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>Reset a register or output. Registers are defined in programming.</td>
</tr>
<tr>
<td>P</td>
<td>Block Print Request</td>
<td>Initiates a block print output. Registers are defined in programming.</td>
</tr>
</tbody>
</table>

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to invalid commands. The following procedure details construction of a command string:

1. The first characters consist of the Node Address Specifier (N) followed by a 1 or 2 character address number. The address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.

2. After the address specifier, the next character is the command character.
3. The next character is the Register ID. This identifies the register that the command affects. The P command does not require a Register ID character. It prints according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See Timing Diagram figure for differences between terminating characters.

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>VALUE DESCRIPTION</th>
<th>REGISTER ID</th>
<th>APPLICABLE COMMANDS/COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Input</td>
<td>INP</td>
<td>T, P</td>
</tr>
<tr>
<td>B</td>
<td>Total</td>
<td>TOT</td>
<td>T, R, R (Reset command resets total to zero)</td>
</tr>
<tr>
<td>C</td>
<td>Max Input</td>
<td>MAX</td>
<td>T, R, R (Reset command resets Max to current reading)</td>
</tr>
<tr>
<td>D</td>
<td>Min Input</td>
<td>MIN</td>
<td>T, R, R (Reset command resets Min to current reading)</td>
</tr>
<tr>
<td>E</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>T, P, V, R (Reset command resets the setpoint output)</td>
</tr>
<tr>
<td>F</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Setpoint 3</td>
<td>SP3</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Setpoint 4</td>
<td>SP4</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Analog Output</td>
<td>AOR</td>
<td>T, V</td>
</tr>
<tr>
<td>J</td>
<td>Control Status</td>
<td>CSR</td>
<td>T, V</td>
</tr>
</tbody>
</table>

Command String Examples:

1. Node address = 17, Write 350 to Setpoint 1, response delay of 2 msec min String: N17VE350S
2. Node address = 5, Read Input value, response delay of 50 msec min String: NSTA*
3. Node address = 0, Reset Setpoint 4 output, response delay of 50 msec min String: RH*
Sending Numeric Data

Numeric data sent to the meter must be limited to 5 digits (-19,999 to 99,999). If more than 5 digits are sent, the meter accepts the last 5. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: the meter’s scaled decimal point position = 0.0 and 25 is written to a register. The value of the register is now 2.5 in this case, write a value = 25.0).

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Receiving Data

Data is transmitted by the meter in response to either a transmit command (T), a print block command (P) or User Function print request. The response from the meter is either a full field transmission or an abbreviated transmission. In this case, the response contains only the numeric field. The meter response mode is established in programming.

Full Field Transmission

<table>
<thead>
<tr>
<th>Byte Description</th>
<th>1</th>
<th>2</th>
<th>2 byte Node Address field [00-99]</th>
<th>3</th>
<th>&lt;SP&gt; (Space)</th>
<th>4-6 3 byte Register Mnemonic field</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-18</td>
<td>19</td>
<td>&lt;CR&gt; carriage return</td>
<td>20</td>
<td>&lt;LF&gt; line feed</td>
<td>21</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
</tbody>
</table>

* These characters only appear in the last line of a block print.

The numeric data is transmitted next. The numeric field is 12 characters long (to accommodate the 10 digit totalizer), with the decimal point position floating within the data field. Negative value have a leading minus sign. The data field is right justified with leading spaces.

The end of the response string is terminated with a carriage return <CR> and <LF>. When block print is finished, an extra <SP><CR><LF> is used to provide separation between the blocks.

Abbreviated Transmission

| Byte Description | 1-12 12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point | 13 | <CR> carriage return | 14 | <LF> line feed | 15 | <SP> (Space) | 16 | <CR>* carriage return |

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| Byte Description | 1-12 12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point | 13 | <CR> carriage return | 14 | <LF> line feed | 15 | <SP> (Space) | 16 | <CR>* carriage return |

Note: Avoid writing values <0A> (LF), <0D> (CR), <24> ($) and <2E> (*) to the CSR. These values are interpreted by the meter as end of command control codes and will prematurely end the write operation.

Meter Response Examples:

1. Set output to full scale:
   
   7 6 5 4 3 2 1 0 : bit location

   VJ<30>* or VJ0* ASCII 0 = 0 0 1 1 0 0 0 0 or <30>

2. Turn SP1, SP3 outputs on and SP2, SP4 outputs off:

   7 6 5 4 3 2 1 0 : bit location

   VJ<35>* or VJ5* ASCII 5 = 0 0 1 0 1 0 1 0 or <35>

3. Select Automatic mode:

   7 6 5 4 3 2 1 0 : bit location

   VJ<40>* or VJ4* ASCII 0 = 0 0 0 0 0 0 0 0 or <40>

Although the register is bit mapped starting with bit 7, HEX <> characters are sent in the command string. Bits 7 and 5 always stay a zero, even if a “1” is sent. This allows ASCII characters to be used with terminals that may not have extended character capabilities.

Writing a “1” to bit 4 of CSR selects manual mode. In this mode, the setpoint outputs are defined by the values written to the bits b0, b1, b2, b3; and the analog output is defined by the value written to the AOR. Internal control of these outputs is then overridden.

In automatic mode, the setpoint outputs can only be reset off. Writing to the setpoint output bits of the CSR has the same effect as a Reset command (R). The contents of the CSR may be read to interrogate the state of the setpoint outputs and to check the status of the temperature sensor (TC or RTD only).

Examples:

1. Set manual mode, turn all setpoints off:

   7 6 5 4 3 2 1 0 : bit location

   VJ<30>* or VJ0* ASCII 0 = 0 0 1 1 0 0 0 0 or <30>

2. Turn SP1, SP3 outputs on and SP2, SP4 outputs off:

   7 6 5 4 3 2 1 0 : bit location

   VJ<35>* or VJ5* ASCII 5 = 0 0 1 0 1 0 1 0 or <35>

3. Select Automatic mode:

   7 6 5 4 3 2 1 0 : bit location

   VJ<40>* or VJ4* ASCII 0 = 0 0 0 0 0 0 0 0 or <40>

Note: Avoid writing values <0A> (LF), <0D> (CR), <24> ($) and <2E> (*) to the CSR. These values are interpreted by the meter as end of command control codes and will prematurely end the write operation.

(AOR) Analog Output Register

The Analog Output Register controls the analog output of the meter. The manual mode must first be engaged by setting bit 4 of the Control Status Register. The range of values of this register is 0 to 4095, which corresponds to 0 mA, 0 V and 20 mA, 10 V; respectively. The table lists correspondence of the output signal with the register value.

<table>
<thead>
<tr>
<th>Register Value</th>
<th>Output Signal*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00 0.00</td>
</tr>
<tr>
<td>1</td>
<td>0.005 0.0025</td>
</tr>
<tr>
<td>2047</td>
<td>10.000 5.000</td>
</tr>
<tr>
<td>4094</td>
<td>19.995 9.9975</td>
</tr>
<tr>
<td>4095</td>
<td>20.000 10.000</td>
</tr>
</tbody>
</table>

*Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (20 mA or 10 V).

Writing to this register while the meter is in the manual mode causes the output signal to update immediately. While in the automatic mode, this register may be written to, but the output will not update until the meter is placed in manual mode.

Examples:

1. Set output to full scale:

   V14095*

2. Set output to zero scale:

   V10*
COMMAND RESPONSE TIME

The meter can only receive data or transmit data at any one time (half-duplex operation). The meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

Timing Diagrams

NO REPLY FROM METER

Command String Transmission Ready

Meter Response Time t1 t2

Command Terminator Received

RESPONSE FROM METER

Command String Transmission Ready

Meter Response Time t1 t2 t3

Command Terminator Received First Character of Reply

Reply Transmission Time

At the start of the time interval t1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t1, the command characters are under transmission and at the end of this period, the command terminating character (*) is received by the meter. The time duration of t1 is dependent on the number of characters and baud rate of the channel.

\[ t_1 = \frac{10 \times \text{# of characters}}{\text{baud rate}} \]

At the start of time interval t2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t2 varies from 2 msec to 50 msec. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t2 is controlled by the use of the command terminating character. The standard command line terminating character is ‘*’. This terminating character results in a response time window of 50 msec minimum and 100 msec maximum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with ‘$’ results in a response time window (t2) of 2 msec minimum and 50 msec maximum. The faster response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

At the beginning of time interval t3, the meter responds with the first character of the reply. As with t1, the time duration of t3 is dependent on the number of characters and baud rate of the channel. At the end of t3, the meter is ready to receive the next command.

\[ t_3 = \frac{10 \times \text{# of characters}}{\text{baud rate}} \]

The maximum serial throughput of the meter is limited to the sum of the times t1, t2 and t3.

COMMUNICATION FORMAT

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character.

The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

<table>
<thead>
<tr>
<th>Logic</th>
<th>Interface State</th>
<th>RS232*</th>
<th>RS485*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>mark (idle)</td>
<td>TXD,RXD; -3 to -15 V</td>
<td>a-b &lt; -200 mV</td>
</tr>
<tr>
<td>0</td>
<td>space (active)</td>
<td>TXD,RXD; +3 to +15 V</td>
<td>a-b &gt; +200 mV</td>
</tr>
</tbody>
</table>

* Voltage levels at the Receiver

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is “framed” with a beginning start bit, an optional parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

Start bit and Data bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted. Since the sending and receiving devices operate at the same transmission speed (baud rate), the data is read without timing errors.

Parity bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The PAX meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit.
MODULE 8 - ANALOG OUTPUT PARAMETERS (8-AnLOut)

PARAMETER MENU

**ANALOG OUTPUT TYPE**

Enter the analog output type. For 0-20 mA or 4-20 mA use terminals 18 and 19. For 0-10 V use terminals 16 and 17. Only one range can be used at a time.

**ANALOG OUTPUT ASSIGNMENT**

Enter the source for the analog output to retransmit:
- rEl = Relative (net) Input Value. The Relative Input Value is the Absolute Input Value that includes the Display Offset Value.
- AbS = Absolute (gross) Input Value. The Absolute Input Value is based on Module 1 dSP and INP entries.
- loTotal = Totalizer Value
- Hi = Maximum Display Value
- lo = Minimum Display Value
- S1-S4 = Setpoint Values

**ANALOG LOW SCALE VALUE**

Enter the Display Value that corresponds to 0 mA (0-20 mA), 4 mA (4-20 mA) or 0 VDC (0-10 VDC).

**ANALOG HIGH SCALE VALUE**

Enter the Display Value that corresponds to 20 mA (0-20 mA), 20 mA (4-20 mA) or 10 VDC (0-10 VDC).

**ANALOG UPDATE TIME**

Enter the analog output update rate in seconds. A value of 0.0 allows the meter to update the analog output at the ADC Conversion Rate.

**PROBE BURN-OUT ACTION**

Enter the probe burn-out action. In the event of a temperature probe failure, the analog output can be programmed for low or high scale.

MODULE 9 - FACTORY SERVICE OPERATIONS (9-FACtory)

**PARAMETER MENU**

**RESTORE FACTORY DEFAULTS**

Use the arrow keys to display Code 66 and press P. The meter will flash rESEt and then return to Code 50. Press the P key to return to Display Mode. This will overwrite all user settings with the factory settings.

**MODEL AND CODE VERSION**

The meter will display the model (PR) on Line 1, and the code version (UE r x.xx) on Line 2.

**CALIBRATION**

The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed in Module 1. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter. When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters. However, it may affect the accuracy of the input signal values previously stored using the Apply (APPLY) Scaling Style.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at the Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

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